second table when said evaluation unit detects a high field intensity and a high error rate at the same time.

A1

15. (Amended) The device according to claim 9, wherein an optimal frequency swing is selected lower for a maximal range than a frequency swing for a maximal interference immunity.

16. (Amended) The device according to claim 9, wherein said device is designed for a transmission according to the DECT standard.

REMARKS

The present Amendment revises the specification and claims to conform to United States patent practice, before examination of the present PCT application in the United States National Examination Phase. Pursuant to 37 CFR 1.125 (b), applicants have concurrently submitted a substitute specification, excluding the claims, and provided a marked-up copy. All of the changes are editorial and applicant believes no new matter is added thereby. The amendment of claims 1-16 is not intended to be a surrender of any of the subject matter of those claims.

Early examination on the merits is respectfully requested.

Submitted by,

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Appendix A
Mark Ups for Claim Amendments

This redlined draft, generated by CompareRite (TM) - The Instant Redliner, shows the differences between -
original document : Q:\DOCUMENTS\YEAR 2000\P001879-WAGNER-FSK WIRELESS DATA XMISSION\ORIGINAL CLAIMS.DOC
and revised document: Q:\DOCUMENTS\YEAR 2000\P001879-WAGNER-FSK WIRELESS DATA XMISSION\CLEAN AMENDED CLAIMS.DOC

CompareRite found 108 change(s) in the text

Deletions appear as Overstrike text surrounded by []
Additions appear as Bold-Underline text

1. [~~Method~~]**(Amended) A method** for wirelessly transmitting data according to an FSK method, [
]comprising the following steps:

[~~-~~]receiving [~~(1, 3)~~] data**;**[~~,~~
~~-~~]

measuring [~~(6) the~~] **an** error rate of [~~the~~] **said** received data**;**[~~,~~
~~-~~]

evaluating [~~(6) the~~] **said** error rate and [~~the~~] **a** field intensity, **producing an evaluation result; and**[~~-~~]

adjusting [~~(5, 6, 10) the~~] **a** frequency swing of [~~the~~] **said** FSK method, which is utilized for wirelessly transmitting [~~(15)~~] data dependent on [~~the~~] **said** evaluation [~~(12)~~] of [~~the~~] **said** error rate and [~~the~~] **said** field intensity in order to optimize [~~(13) the~~] transmission behavior.

2. [~~Method~~]**(Amended) The method** according to claim 1, **wherein said** [~~c h a r a c t e r i z e d i n t h a t~~
~~the~~] frequency swing is modified within a preadjusted range.

3. **(Amended) The method according to claim 1, further comprising the step of basing said optimized transmission behavior on a table reproducing an** [~~Method according to one of the previous claims,~~

~~characterizedinthat~~
~~the transmission behavior is optimized on the basis of a table (12) reproducing the~~] obtainable range of [~~the~~] **said** transmission [~~(15)~~] dependent on [~~the~~] **said** adjusted frequency swing.

4. [~~Method~~]**(Amended) The method** according to claim 3, **further comprising the step of optimizing said** [~~characterizedinthat~~
~~the~~] frequency swing [~~is optimized (13)~~] toward a maximal range [~~on the basis of the~~] **based on said** table [~~(12)~~] when [~~the~~] **said** evaluation [~~(6)~~] result is a low [~~frequency~~] **field** intensity and a low [~~frequency~~] **error** rate at the same time.

5. **(Amended) The method according to claim 1, further comprising the step of basing said optimized** [~~Method according to one of the previous claims,~~
~~characterizedinthat~~
~~the~~] transmission behavior [~~is optimized on the basis of~~] **on** a second table [~~(14)~~] reproducing [~~the~~] **an** obtainable interference immunity of [~~the~~] **said** transmission [~~(15)~~] dependent on [~~the~~] **said** adjusted frequency swing.

6. [~~Method~~]**(Amended) The method** according to claim 5, **further comprising the step of optimizing said** [~~characterizedinthat~~
~~the~~] frequency swing [~~is optimized (13)~~] toward a maximal interference immunity [~~on the basis of the~~] **based on said** second table [~~(14)~~] when [~~the~~] **said** evaluation [~~(6)~~] result is a high field intensity and a high error rate at the same time.

7. **(Amended) The method according to claim 1, wherein said transmission** [~~Method according to one of the previous claims,~~
~~characterizedinthat~~
~~the transmission (15)~~] ensues according to the DECT standard.

8. **(Amended) The method according to claim 1, further comprising the step of selecting an** [~~Method according to one of the previous claims,~~
~~characterizedinthat~~

~~the~~] optimal frequency swing [~~is selected~~] lower for a maximal range than the frequency swing for a maximal interference immunity.

9. [~~Device~~]**(Amended) A device** for wirelessly transmitting data according to an FSK method, [
]comprising:

[~~-~~]a receiver [~~(3),~~] **for receiving data;**

[~~- a~~]**a first** measuring device [~~(6)~~] for [~~the~~] **measuring an** error rate of **said** received data;[~~,~~
~~-~~]

a second measuring device [~~(3)~~] for [~~the~~] **measuring a** field intensity [~~(8)~~] during [~~the~~] **said** reception of [~~the~~] data;[~~,~~
~~-~~]

an evaluation unit [~~(6)~~] for [~~the~~] **evaluating said** measured error rate [~~an~~] and [~~the~~] **said** measured field intensity;[~~,~~
~~-~~]

a control unit [~~(13)~~] for adjusting [~~the~~] **a** frequency swing of the FSK method, which is utilized for wirelessly transmitting [~~(15)~~] data by a transmitter [~~(5)~~] dependent on [~~the~~] **said** measured error rate and [~~the~~] **said** measured field intensity in order optimize [~~the~~] transmission behavior.

10. [~~Device~~]**(Amended) The device** according to claim 9, **wherein said** [~~c h a r a c t e r i z e d i n t h a t~~
~~the~~] frequency swing can be modified within a preadjusted range.

11. **(Amended) The device according to claim 9, wherein said evaluation unit further comprises a first table reproducing an** [~~Device according to one of the claims 9 or 10,~~
~~c h a r a c t e r i z e d i n t h a t~~

~~the evaluation unit (6) contains a table (12) reproducing the]~~ obtainable range of [~~the~~] **a** transmission [~~(15)~~] dependent on [~~the~~] **said** adjusted frequency swing for purposes of optimizing [~~the~~] transmission behavior.

12. [~~Device~~]**(Amended) The device** according to claim 11, **wherein said**[~~=~~
~~c h a r a c t e r i z e d i n t h a t~~
~~the~~] frequency swing is optimized [~~(13)~~] toward a maximal range on the basis of [~~the~~] **said first** table [~~(12)~~] when [~~the~~] **said** evaluation unit [~~(6)~~] detects a low field intensity and a low error rate at the same time.

13. **(Amended) The device according to claim 9, wherein said evaluation unit further comprises a second table reproducing an** [~~Device according to one of the claims 9 through 12,~~
~~c h a r a c t e r i z e d i n t h a t~~
~~the evaluation unit (6) contains a second table (14) reproducing the~~] obtainable interference immunity of [~~the~~] **a** transmission [~~(15)~~] dependent on [~~the~~] **said** adjusted frequency swing for purposes of optimizing [~~the~~] transmission behavior.

14. [~~Device~~]**(Amended) The device** according to claim 13, **wherein said** [~~c h a r a c t e r i z e d i n t h a t~~
~~the~~] frequency swing is optimized [~~(13)~~] toward a maximal interference immunity on the basis of [~~the secon [sic]~~] **said second** table [~~(14)~~] when [~~the~~] **said** evaluation unit [~~(6)~~] detects a high field intensity and a high error rate at the same time.

15. **(Amended) The device according to claim 9, wherein an** [~~Device according to one of the claims 9 through 14,~~
~~c h a r a c t e r i z e d i n t h a t~~
~~the~~] optimal frequency swing is selected lower for a maximal range than [~~the~~] **a** frequency swing for a maximal interference immunity.

16. **<u>(Amended) The device according to claim 9, wherein said device</u>** [~~Device according to one of the claims 9 through 15,~~

~~c h a r a c t e r i z e d i n t h a t~~

~~it~~] is designed for a transmission [~~(15)~~] according to the DECT standard.

This redlined draft, generated by CompareRite (TM) - The Instant Redliner, shows the differences between - original document : Q:\DOCUMENTS\YEAR 2000\P001879-WAGNER-FSK WIRELESS DATA XMISSION\ORIGINAL COMPARE SPEC.DOC and revised document: Q:\DOCUMENTS\YEAR 2000\P001879-WAGNER-FSK WIRELESS DATA XMISSION\SUBSTITUTE SPECIFICATION.DOC

CompareRite found 100 change(s) in the text

Deletions appear as Overstrike text surrounded by []
Additions appear as Bold-Underline text

[~~Siemens AG~~]**SPECIFICATION**

[~~New PCT application~~
~~26965-0667~~
~~GR 98 P 1899 P US~~
~~Inventor: Wagner~~

~~Translation / December 8, 2000 / 1262 / 3170 words~~] **TITLE**

METHOD AND DEVICE FOR WIRELESS DATA TRANSMISSION OF DATA ACCORDING TO AN FSK METHOD, ESPECIALLY A GFSK METHOD

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a device and method for the wireless data transmission of data according to an FSK method such as the GFSK method, as it, among other things, is used according to the DECT standard.

Description of the Related Art

According to a DECT standard, data is modulated according to a GFSK (Gaussian Frequency Shift Keying) method. For example, David, Benker, [~~ADigitale~~]**"Digitale** Mobilfunksysteme, Taeubner Verlag, [~~Stuttgardt~~] **Stuttgardt"**, 1996, ISBN 3-519-06181-3 [~~can be cited as references concerning~~] **discloses** details of the DECT standard. According to the DECT standard, data is transmitted in a frequency range of 1880 to1900 MHz (in the extended case**,** up to 1930 MHz) in 120 duplex channels[~~. The~~] **having a** channel spacing

[~~thereby is~~] **of** 1728 kHz. The TDMA access method [~~having~~] **uses** frames of 10 ms [~~is used~~]. The TDD method is used as duplex method.

[~~The present invention can be applied with respect to all FSK methods and their derivatives.~~

~~While~~] **For amplitude keying,** the amplitude of a carrier wave is changed by the modulation of the data signals [~~during the amplitude keying, and~~]**, this carrying the information;** the frequency, however, remains constant[~~, the~~]**. For** frequency keying (FSK, Frequency Shift Keying) [~~is~~] the exact opposite **is true**, i.e., the information is contained in the frequency. The abrupt changeover from one frequency to another, however, leads to relatively high spectral secondary sidebands, so that a high bandwidth is occupied by the transmission signal. A baseband filtering can improve this behavior. A frequency filter g(t) is used, which does not exhibit a rectangular curve but rather a smoothened curve. The smoothing function can be assumed by a Gaussean low-pass filter, for example[~~. A~~]**, thus resulting in a** GFSK modulation [~~is thus~~] **being** received.

The impulse response h (t) of a Gaussean low-pass filter is:

$$h(t) = \sqrt{\frac{2\pi}{\ln 2}} B \exp\left(- \frac{2\pi^2 B^2}{\ln 2} t^2 \right)$$

[~~whereby~~] **where** B is the 3 dB cutoff frequency. The Gaussean low-pass filter can be switched directly in front of the modulation input of a VCO. Pulses deriving from the convolution of the original rectangular pulses with the impulse response of the Gaussean low-pass filter are then present at the modulation input:

$$g(t) = \frac{1}{2}\left[erf\left(\sqrt{\frac{2}{\ln 2}} \pi B \frac{t + T/2}{T} \right) - erf\left(\sqrt{\frac{2}{\ln 2}} \pi B \frac{t - T/2}{T} \right) \right]$$

[~~Hereby~~] **Here**, erf(x) is the Gaussean error function:

$$erf(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-u^2} du$$

The GFSK transmission filter can be unambiguously marked by its modulation index [~~(ABT relationship@)~~]**("BT relationship")**. Figure 6 shows the impulse response of the transmission filter for different modulation indices (BT). It can be seen that the impulse

response becomes broader for modulation indices becoming smaller, so that a [~~Apartial response@~~]**"partial response"** behavior occurs.

For the application in DECT devices, the modulation method GFSK has been specified with a nominal modulation index (BT) of 0.5, [~~whereby this~~] **which** corresponds to a frequency swing of 288 kHz. A range of 202 kHz through 403 kHz is allowable with respect to the frequency swing [~~given the fixing of~~] **when** the modulation index **is fixed**.

According to the prior art, the frequency swing is set to a fixed [~~value,~~] **value—thus,** an adaptation [~~therefore~~] is not possible.

SUMMARY OF THE INVENTION

Therefore, the present invention is based on the object of creating a possibility for creating the adaptation of a wireless transmission of data according to an FSK method to different environmental scenarios. **The present invention, can be applied with respect to all FSK methods and their derivatives.**

According to the [~~According to the idea of the~~] invention, the frequency swing of an FSK method, for example of the [~~GSK~~] **GFSK** method, is modified dependent on different parameters.

[~~To be more precise, the aforementioned object is achieved by the features of claims 1 and 9. The subclaims form the inventive idea in a particularly advantageous way.~~]

According to the invention, a method for wirelessly transmitting data according to an FSK method is provided. [~~Data are thereby~~] **In this method, data are** received and the error rate (BER, Bit Error Rate) of the received data is measured. The field intensity (RSSI value) of the received data is measured at the same time. The error rate and the field intensity are evaluated. Depending on the evaluation of the error rate and the field intensity, the frequency swing of the FSK method used for wirelessly transmitting data is adjusted in order to optimize the transmission behavior.

The frequency swing can [~~thereby~~] be modified within a preadjusted range. [

]The transmission behavior can be optimized on the basis of a table reproducing the obtainable transmission range dependent on the adjusted frequency swing. [

]If the evaluation result is a low field intensity and a low error rate at the same time, the frequency swing, on the basis of the cited table, can be optimized with respect to a maximal range. [

]The transmission behavior can be optimized on the basis of a second table, which reproduces the obtainable interference immunity of the transmission dependent on the adjusted frequency swing. [

]If the evaluation result is a high field intensity and a high error rate at the same time, the frequency swing can be optimized with respect to a maximal interference immunity on the basis of the [~~cited~~] second table. [

]The transmission can ensue according to the DECT standard. [

]The optimal frequency swing can be selected lower for a maximal range than the frequency swing for a maximal interference immunity.

According to the present invention, a device for wirelessly transmitting data according to an FSK method - as it is used according to the DECT standard, for example - is also provided. The device comprises a receiver and a first measuring device for the error rate (BER, Bit Error Rate) of the received data. Furthermore, a second measuring device is provided for the field intensity during the reception of the data. An evaluation unit processes the measured error rate and the measured field intensity. A control unit is also provided in order to adjust the frequency swing of the FSK method, which is used for the wireless transmission of data by a transmitter, dependent on the measured error rate and the measured field intensity for purposes of optimizing the transmission behavior.

Further features and advantages of the present invention are [~~exemplary~~] explained **by way of example** in greater detail on the basis of an exemplary embodiment and with reference to the appertaining figures[~~; shown are:~~].

~~[Figure 1]~~**BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 **is a block diagram illustrating** the structure of an inventive device for wirelessly transmitting data according to an FSK method[~~,~~];

Figure 2 **is a logarithmic graph illustrating** the bit error rate dependent on the signal-to-noise ratio (SNR) according to a simulation[~~.~~]**;**

Figure 3 **is a logarithmic graph illustrating** the bit error rate of a wireless transmission dependent on the signal-to-noise ratio for a frequency swing of the disturb signal of 340 kHz,

Figure 4 **is a logarithmic graph illustrating** the bit error rate dependent on the signal-to-noise ratio for a frequency swing of the disturb signal of 288 kHz,

[~~Figure 5a~~]**Figures 5a-d are spectral frequency graphs illustrating** the different spectrums of GFSK signals, which have been used for the [~~-5d~~] measuring according to the figures 2 through 4[~~,~~]**;** and

Figure 6 **is a response graph illustrating** the impulse response g (t) of a GFSK filter.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is generally applied with respect to FSK methods and is described on the basis of [~~a~~] **an exemplary** GFSK method[~~, for example.~~]**.**

[~~According to the~~] **The** present invention[~~,~~] **utilizes** the phenomenon that a different system behavior of [~~the~~] **a** wireless transmission - dependent on the adjusted modulation index (BT value) of an FSK method[~~,~~] **(**for example**,** of the GFSK method**)** - results with respect to the tangential signal sensitivity (range) or the resistance to jamming, for example[~~, is utilized~~]. If an optimally large range is desired for the transmission, the frequency swing [~~to be~~] selected [~~therefor~~] **therefore** inventively differs from the frequency swing of a system that is optimized with respect to maximal resistance to jamming. [~~According~~] **Thus, according** to the present invention, [~~an adaptation of~~] the system **is adapted** to different scenarios [~~therefore is undertaken~~] by a corresponding adjustment of the frequency swing (corresponding to a modulation index) after the bit error rate (BER, Bit Error Rate) and the corresponding RSSI (Radio Signal Strength Indicator, reception field intensity) value have been evaluated.

As shown in Figure 1, digitally modulated signals can be received by an antenna 1 and can be forwarded to a receiver 3. The receiver 3 forwards the received data (RX data) 7, on one hand, and the RSSI value 8, on the other hand, to an evaluation unit 6. ~~[In order to be more precise]~~ **More precisely**, the receiver 3 forwards the received data 7 and the RSSI value 8 to a control unit 13 in the evaluation unit.

In addition to the control unit 13, the evaluation unit 6 comprises a first table 12 and a second table 14, which are respectively connected to the control unit 13. On one hand, the control unit 13 in the evaluation unit 6 drives a local oscillator (synthesizer) **4 via a control channel 9**, which is connected to the receiver 3 and to a transmitter 5 of the mobile radio device 16. On the other hand, the control unit 13 of the evaluation unit 6 ~~[d rives]~~ **drives** the frequency swing 10, which is utilized by the transmitter 5. The evaluation unit 6 forwards **the** data 11 to be transmitted to the transmitter 5, which modulates these data (TX data) 11, with the frequency swing 10 prescribed by the control unit 13, onto the frequency of the local oscillator (synthesizer) 4 and which then forwards them to an antenna 2 for purposes of sending them via a wireless transmission path 15.

The reception data 7 and the RSSI value 8 therefore are transmitted to the control unit 13 in the evaluation unit 6 by the receiver 3. The bit error rate of the received data 7 and the reception field intensity (RSSI value) measured by the receiver 3**, by the respective first measuring device 17 and the second measuring device 18,** are evaluated in the control unit 13, ~~[so that there are]~~ **resulting in** the following different scenario:

Case a)

No or little influence by ~~[disturb]~~ **disturbing** signals:

The received data 7 have low bit error rates given a low reception field intensity at the same time. In this case, the control unit 13 can drive the frequency swing of the transmitter 5 with respect to a maximal range.

Case b)

Interferences as a result of other signals such as DECT signals:

In this case, the bit error rates are relatively high given relatively high reception field intensities. In this case, the control unit 13 of the evaluation unit 6 controls

[[~~sic~~]] the frequency swing of the transmitter 5 with respect to maximal interference immunity.

The first table 12 and the second table 14 are provided in the evaluation unit 6 for optimizing the system with respect to a maximal range or[~~, respectively,~~] a maximal interference immunity. The first table 12 indicates the maximally obtainable range of the wireless transmission dependent on [~~th [sic]~~] **the** frequency swing that can be selected within an allowed range. The second table 14 represents the maximal interference immunity dependent on the frequency swing.

The tables 12 and 14 are prepared, for example**,** prior to the actual transmission, by an analysis of the system behavior of the wireless transmission 15 by simulations with different frequency swings. In Figure 2, the bit error rate has been calculated dependent on the signal-to-noise ratio. The curves entered in Figure 2 represent the following cutoff data: **1)** Frequency swing of 202 kHz: Lower limit of the allowed standard, **2)** Frequency swing of 288 kHz: Nominal value, **3)** Frequency swing of 340 kHz: Frequency swing as it is firmly adjusted in some devices according to the prior art, **and 4)** Frequency swing of 403 kHz: Upper allowed limit of the DECT standard.

It can be concluded, by evaluating the diagram shown in Figure 2, that a frequency swing of 340 kHz is to be adjusted [~~given~~] **for** a system that is optimized with respect to maximal range; this corresponds to the above-cited case a).

The characterizations of the resistance to jamming of a DECT connection (case b)) derive from further simulations. According to the calculations shown in the Figures 3 and 4, it can be seen that the coexistence of different systems [~~is to~~] **should** be continued to be viewed in this scenario. [~~Given~~] **For** a [~~disturb~~] **disturbing** signal having a 340 kHz frequency swing (e.g.**,** neighboring traditional DECT systems), the optimal frequency, as it [~~is to~~] **should** be utilized with respect to the present invention - is also at 340 kHz (see Figure 3). According to the present invention, the nominal frequency swing of 288 kHz is adjusted [~~given~~] **for** co-channel interferences with respect to all systems (Figure 4).

[~~Figure~~] **Figures** 5a through 5d show the test signals utilized during the simulations.

According to the present invention, an adaptation of the system to different scenarios can be undertaken by evaluating the bit error rate and the corresponding RSSI value by a corresponding adjustment of the frequency swing of an FSK transmission.

~~[Abstract]~~ **The above-described method and device are illustrative of the principles of the present invention. Numerous modifications and adaptations thereof will be readily apparent to those skilled in this art without departing from the spirit and scope of the present invention.**

~~[Method and device for wireless data transmission according to an FSK method, especially a GFSK method]~~ **ABSTRACT**

According to the present invention, a mobile radio device is provided for wirelessly transmitting data according to a GFSK method, as performed, for example, with DECT devices. The device comprises a receiver ~~[(6)]~~**(3)**, a first measuring device ~~[(6)]~~**(17)** for the error rate of received data and a second measuring device ~~[(3)]~~**(18)** for the field intensity (8) during the reception of data. An evaluation unit (6) processes the measured error rate and the measured field intensity. Depending on the measured error rate and the measured field intensity, a control unit (13) adjusts the frequency swing of the GFSK method, which is utilized for wirelessly transmitting (15) the data by a transmitter (5) in the mobile radio device (16), for purposes of optimizing the transmission behavior. In order to optimize the transmission behavior, the evaluation unit (6) contains a first table (12) and a second table (14) reproducing the obtainable range or~~[, respectively,]~~ the obtainable interference immunity of the transmission (15) dependent on the selected frequency swing.

~~[Figure 1]~~